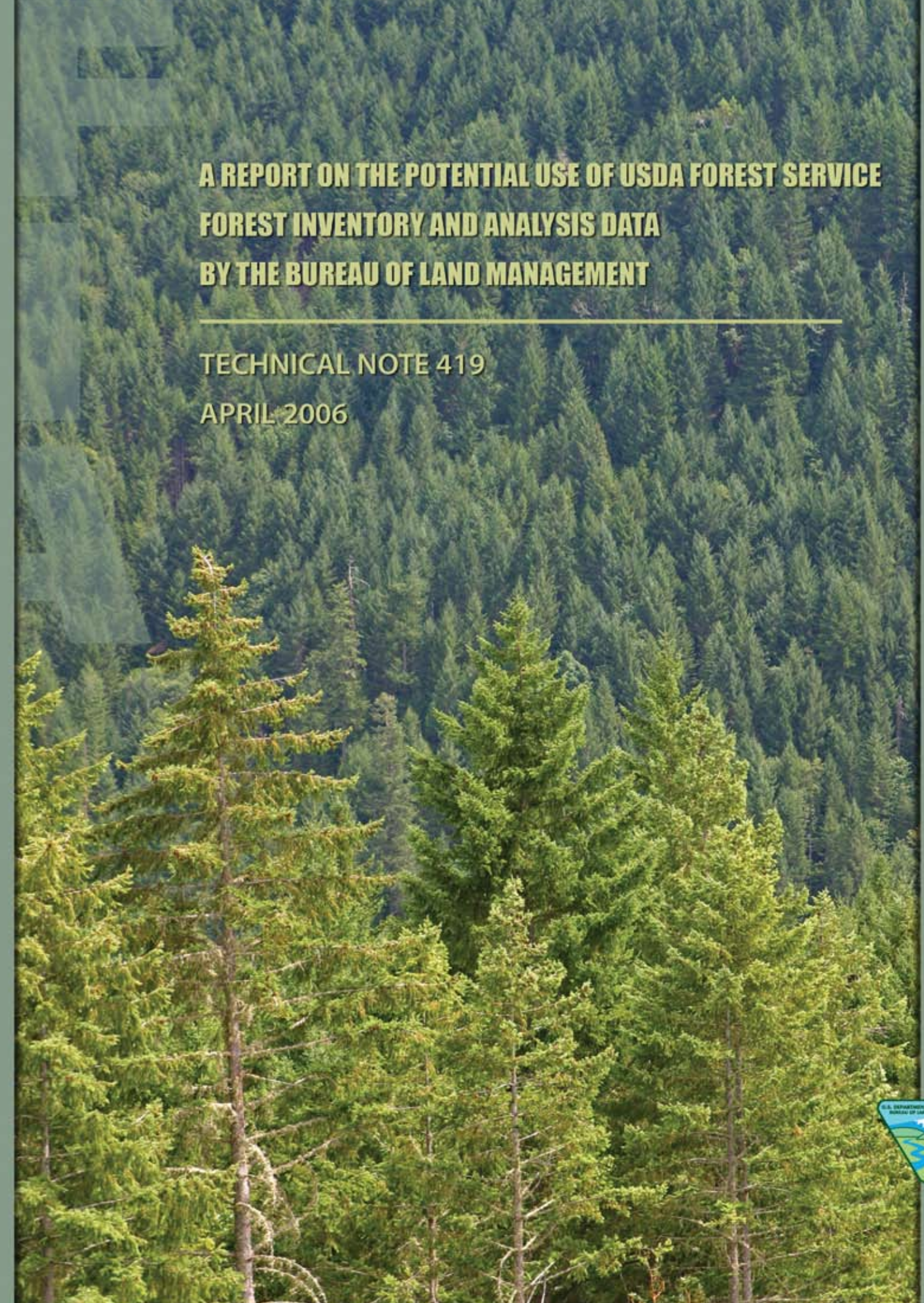
BLM

A REPORT ON THE POTENTIAL USE OF USDA FOREST SERVICE FOREST INVENTORY AND ANALYSIS DATA BY THE BUREAU OF LAND MANAGEMENT

TECHNICAL NOTE 419

APRIL 2006

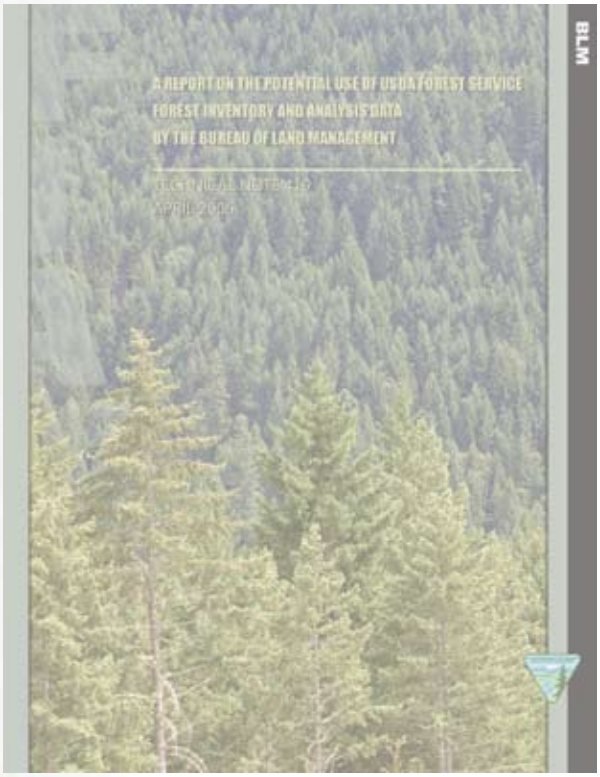


Production services were provided by:

BLM National Science and Technology Center
Branch of Publishing Services

This document is available online at *http://www.blm.gov/nstc/library/techno2.htm*

Technical Note 419
BLM/ST/ST-06/001+5100



Technical Note 419
April 2006

A Report on the Potential Use of USDA Forest Service
Forest Inventory and Analysis Data
by the Bureau of Land Management

By:

Bill Williams, Forester
Bureau of Land Management
National Science and Technology Center
Denver, Colorado

Tracey Frescino, Forester
Larry DeBlander, Forester
Sharon Woudenberg, Information Management Team Leader
Michael J. Wilson, Assistant Station Director—FIA
Interior West Forest Inventory and Analysis
USDA Forest Service
Rocky Mountain Research Station
Ogden, Utah

Contents

Suggested Citation

Williams, B., T. Frescino, L. DeBlander, S. Woudenberg, and M.J. Wilson. 2006. A Report on the Potential Use of USDA Forest Service Forest Inventory and Analysis Data by the Bureau of Land Management. Technical Note 419. BLM/ST/ST-06/001+5100. Bureau of Land Management, Denver, CO. 32 pp.

Abstract

The Bureau of Land Management (BLM) does not have a consistent internal program or source of vegetation data to use for strategic level planning, such as in resource management plans. This technical note discusses and evaluates the potential of the USDA Forest Service Forest Inventory and Analysis (FIA) Program to assist the BLM in filling this data gap. The FIA program is the Forest Service's national program for collecting and reporting information on status and trends in forested ecosystems. The FIA is considered here because it is the only standard, nationwide, systematic assessment of forest land available. The technical note poses five questions about the use of FIA data by the BLM for purposes such as strategic planning, the use of FIA spatial products, modeling or predicting areas at risk of disturbance from fires, insects, or disease, and assessing the extent of weeds or exotic species. The technical note then discusses the uses for which the FIA data would be meaningful and the uses for which extra effort would be required.

Purpose of the Report

This technical note addresses the potential of USDA Forest Service Forest Inventory and Analysis (FIA) data and reports for use by the Bureau of Land Management (BLM). BLM does not have a consistent internal program or source of vegetation data to use for strategic level planning, such as in resource management plans. Data and information from other external sources were considered, but the FIA program, because of its scope and history, had the most potential. This technical note discusses five basic questions about FIA's data and delivery options.

Question 1: Are the standard FIA reports and tables useful for BLM strategic planning?

Question 2: What is the potential for using FIA basic data for BLM strategic planning?

Question 3: Is there a potential use for Interior West FIA (IWFIA) spatial (map) products?

Question 4: Can BLM supplement the FIA sample plots to increase the utility of FIA data?

Question 5: Can BLM use FIA plot data to model or predict areas at risk of disturbance from fire, insects, or disease or to assess the extent of weeds or exotic species?

Introduction to the Forest and Inventory Analysis Program

The FIA program is the Forest Service's national program for collecting and reporting information on status and trends in forested ecosystems. Managed through Forest Service Research and Development, the FIA program has been in continuous operation since the first inventory was completed in 1933. The FIA mission, as outlined in the Forest and Rangeland Renewable Resources Research Act of 1978, is to report periodically on all of the Nation's public and private forests. This includes information on status and trends in area, location, growth, mortality, harvesting, composition, and structure of forests.

FIA conducts resource inventories on all lands, including those lands administered by the USDI Bureau of Land Management, Bureau of Indian Affairs, and National Park Service; State, county, and municipal governments; and lands owned by private individuals and businesses.

FIA also collects data from loggers on utilization efficiency; from wood processing mills on types of wood products made; and from private landowners on management goals, interests, and demographics.

Historically, FIA data were collected on State-by-State cycles within six different regions of the country. The typical inventory process included a complete statewide stratification using aerial photography; field visits to collect ground data; visits to logging operations and wood processing facilities to track utilization rates; and data compilation, analysis, and reporting. The cycle (time between re-measurements of a given State) has varied from 7 to10 years in the South to 12 to15 years in the North to 20 or more years in the West.

A recent amendment to the Forest and Rangeland Renewable Resources Act of 1978 legislated new procedures. FIA refers to these procedures as the annual inventory process. The procedures specify that:

- Between 10 and 20 percent of all FIA sample plots will be measured each year in every State.
- A compilation of all the data collected will be made available annually to the public.
- Every 5 years, a report will be prepared, published, and made available to the public (with the cooperation of State foresters) detailing the results of the previous inventories and an analysis of the forest health conditions and trends over the previous two decades.
- National standards and definitions will be implemented to ensure uniform and consistent data collection by the various FIA units located throughout the country.

FIA operates at a strategic scale, with one field sample location approximately every 6,000 acres. FIA data are statistically useful from the national scale down to areas of about 200,000 acres.

The Interior West Forest Inventory and Analysis Program (IWFIA), Rocky Mountain Research Station, Ogden Forestry Sciences Laboratory, conducts forest resource inventories in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming. The FIA unit at the Pacific Northwest Research Station is responsible for inventorying Alaska, Washington, Oregon, and California.

FIA Program Methods

The FIA consists of a nationally consistent core program, which can be enhanced at the regional, State, or local level by collecting additional data to address special interests. The national core program consists of three phases:

Phase 1 uses remote sensing imagery or aerial photography to classify land into forest or non-forest and to identify landscape patterns, such as fragmentation and urbanization. Historically, this phase was accomplished exclusively with aerial photographs. Current methods are shifting to a system based on satellite imagery.

Phase 2 consists of a grid of permanently established field plots distributed across the landscape with approximately one plot every 6,000 acres. In the West, field crews visit 10 percent of forested sample locations each year to collect a variety of forest ecosystem data. Non-forest locations are also visited as necessary to quantify rates of land use change. A typical plot usually takes a two- to three-person field crew one full day to complete. Factors such as the steepness of the ground, size of trees, amount of understory vegetation, and length of the hike to the plot all factor into the time commitment. When a field crew visits a plot, some of the information collected includes:

- Tree diameter, length, damage, amount of rotten or missing wood, and tree quality
- Counts of tree regeneration
- General land use
- Stand characteristics such as forest type, stand age, and disturbance
- Changes in land use and general stand characteristics
- Estimates of growth, mortality, and removals
- Vegetation diversity and structure

Phase 3 is the field plot portion of the Forest Health Monitoring (FHM) detection program as it was integrated into the FIA program. An extended suite of ecological measurements are collected on a subset of FIA plots each year. Field crews gather data on tree species and diameters, crown conditions, tree damage, lichen communities, ozone bioindicators, soils, and down-woody material. FHM reports on forest-related issues on a large scale, usually at the State and regional levels.

FIA Forestland Definition

The FIA definition of forest land is:

> ***Land at least 10 percent stocked by forest trees of any size, including land that formerly had such tree cover and will be naturally or artificially regenerated.***

This is also the BLM definition of forest land. FIA and BLM use tree canopy cover as an estimate of stocking. The IWFIA equates 5 percent canopy cover as 10 percent stocking when defining forest land. BLM has historically equated 10 percent canopy cover to 10 percent stocking for all species. The minimum canopy cover measure to use for defining forest and non-forest land is the subject of debate. In reality, age, potential size, and trees per acre should be factored into the classification because those factors influence whether trees will fully occupy or significantly influence the vegetation structure on a site.

FIA has a minimum area for classification of forest land of 1 acre. Roadside, streamside, and shelterbelt strips of trees must have a crown width of at least 120 feet to qualify as forest land.

FIA statistics include a category of forest land called timberland. Timberland is forest land that is producing or is capable of producing crops of industrial wood and has not been withdrawn from timber utilization by statute or administrative regulation. Timberland must be capable of producing 20 cubic feet of industrial wood per acre per year. BLM "commercial forest land" has the same definition as FIA "timberland." BLM calls forest land that does not meet the timberland criteria "woodland."

Question 1: Are the standard FIA reports and tables useful?

Information from the FIA program is available from two sources: Research Station Reports and the national Forest Inventory and Analysis Database (FIADB). The information is presented in both sources in a standard set of FIA tables.

Research Station Reports

Published data summaries are available in the form of Forest Service Research Station Resource Bulletins. These reports from the periodic inventory were published irregularly for an entire State. The published reports usually summarize the inventory results for a State or occasionally for a portion of a State. Reports include the number of trees, size, wood volume, tree growth, mortality, and harvest removals.

Under the annual inventory process, an updated report of the forests in a State will be produced every 5 years. It has not yet been determined what the report will look like. At this time, work is being conducted on a report template at the Northeast FIA project.

The information in the State-level reports has limited value because BLM lands are usually lumped in an "other public" category, which contains all public lands including Indian reservations, but does not include national forests.

Forest Inventory and Analysis Database (FIADB)

FIA created a database (FIADB) and Web site to provide tables for selected States and counties within a State. Standard or custom output tables can be created by selecting from the specific options provided. For example, tables can be generated showing acres of forest land by forest type, stand size class, and site class on BLM land in a selected set of counties in a State. Tables can be generated for all forest land or for non-reserved timberland. The table descriptions and options use terminology associated with the production of wood products and do not address aspects of forest health and vegetation conditions. This information can be accessed at *http://ncrs2.fs.fed.us/4801/fiadb.*

In addition to Web-application-generated tables, other options for data analysis include:

1. Exporting the FIADB data as a comma-delimited file and importing it to Microsoft Excel to generate charts and graphs.

2. Exporting plot measurement data for an entire State directly from FIADB.

3. Using the FIADB export option that provides plot data in a format ready for use by the Forest Vegetation Simulator (FVS.) There are some missing variables, which are desirable for FVS in the FIA data. The variables that are not in the data include diameter growth or past diameter measurements, site index species codes, habitat type codes, and FVS tree damage codes.

Two limitations exist in the way information is selected and reported from FIADB:

1. To get reports for a BLM field office, you must select a set of counties for a sub-State area. BLM field office boundaries do not coincide with county boundaries; so, the dataset used for the tables or the set of plot data extracted may include plots outside the field office area or may be missing plots that fall within a field office boundary.

2. There is no accuracy assessment (standard deviation or standard error) available for county-level tables from FIADB. One can query for the total number of plots used to generate a table, but there is no way to calculate the precision of the estimate using the Web functions.

BLM is using the numbers from FIADB for the total acres of commercial forest land and woodland in each State for the BLM Annual Report. FIA is being used because it is the only standard, nationwide, systematic assessment of forest land available. BLM does not have a standard process or an internal source for the required data.

Question 2: What is the potential for using FIA basic data for BLM strategic planning?

Because of the spacing of the field plots and BLM's fragmented land pattern, BLM ownership may not provide a large enough sample for the desired precision of the estimates. Two examples illustrate the potential problem.

- BLM administers some 10,000 acres in two western South Dakota counties. FIADB does not have any BLM plots in South Dakota; the database shows no BLM land in the State.
- BLM forest land in the Dillon Field Office has 22 FIA plots; the Forest Service in the same area has 270 plots. The BLM forest land in the Albuquerque Field Office has 40 plots and the Forest Service forest land has 165 plots in the same area.

If the data or data summaries can be obtained, and if BLM-managed land has a statistically adequate number of samples, the basic data has potential use. When standard FIADB query options do not provide adequate information, requests for custom products and data sets are an option. Be sure to realize that this would be a custom request and could require additional response time on the part of the FIA staff.

Standard Tables – The IWFIA staff can produce "standard table" data for BLM ownership in an area. GIS spatial data for the area of interest, such as a BLM field office, is used to locate the plots for the area of interest. The selected plots are then used to generate tables. The tables can be provided in a format for import to Microsoft Excel. Excel can be used to produce charts and graphs from the tabular data.

Appendixes 1 and 2 have tables and graphs for two BLM field offices that were prepared using FIA tables after moving them to Excel. The short narrative description in each appendix is an example of the information provided by the data.

Pivot Table – It is also possible to get the plot data used in the tables in a Microsoft Excel "pivot table." FIA staff can create pivot tables for combinations of plots on BLM-managed land. Use of pivot tables allows generation of custom tables and graphics not available in FIADB or the FIA tables. The use of pivot tables would require training or a tutorial.

Question 3: Is there a potential use for Interior West FIA spatial (map) products?

At IWFIA, efforts are underway to merge regional forest inventory data with satellite-based information to produce spatial products. Staff are using, or have used, Landsat Thematic Mapper (TM), AVHRR, and MODIS data with inventory data and other available ancillary data layers. These other data layers include, for example, the National Elevation Dataset (NED) data to predict forest type, volume, biomass, basal area, number of trees, crown cover, mean diameter, and other vegetation attributes at multiple scales. Most of the efforts have been done to test methodology or to prototype modeling processes.

IWFIA staff have completed prototype ArcView GIS projects where forest attributes, as listed previously, were predicted in each cell in the area of interest. One prototype was done at the request of the BLM National Science and Technology Center. The project area was for the Dillon Field Office (Montana). The modeling "extent" was enlarged to an ecoregion level to increase the number of ground plots for training data for the classification. The project developer provided display and query tools for each theme to allow the user to refine the data used in the view. For example, a user could select a range of canopy cover values to display and could then combine canopy cover with other queries to display forest attributes meeting specific criteria. Example maps from the project are provided in Appendix 3.

The resulting products are useful for showing the general location, at mid to large scales, of forest resources and resource conditions. They may be beneficial for strategic planning efforts for forest lands. A significant limitation of the spatial products is the lack of information about non-forest vegetation cover. FIA reports acres of non-forest; FIA does not report on non-forest cover types.

The work to model forest attributes and build a GIS display tool is significant. If BLM were to make regular requests, it would be an unfunded workload for the IWFIA and BLM would need to provide the funding for the work.

Question 4: Can BLM supplement FIA sample plots to increase the utility of FIA data?

Although it is theoretically possible to supplement the number of sample plots on BLM land to provide better estimates, analytically and logistically it would be difficult and expensive.

Analytically, the question becomes one of how to increase the number of possible sample locations (by intensifying the grid of points) without inducing bias due to the fragmented BLM land pattern. Selecting only additional plots that fall on BLM land and combining them with plots from the normal grid of points might create an unequal probability of selection, and therefore produce a biased sample. There are also questions about how to statistically merge the supplemental plot data (if it is collected at a different time) with the annual cycle data to provide the statistics of interest.

Logistically, the question becomes one of how to increase the sample and over what time period. If a single field office is the target for increased data collection over some period shorter than the annual inventory cycle, it would require separate crews and equipment beyond current FIA capability. The FIA is developing a set of tools for those who want to intensify or supplement FIA data on lands they manage. The tools will include the processes from data collection through data compilation and will allow integration with the available FIA data.

Question 5: Can BLM use FIA plot data to model or predict areas at risk of disturbance from fire, insects, or disease or to assess the extent of weeds or exotic species?

It is possible to build predictive models of forest attributes using FIA plot data in combination with remotely sensed data. (See discussion in Question 3.)

Researchers at the University of Montana used FIA data and the Fire and Fuels Extension to the Forest Vegetation Simulator (FVS) to model fire risk and management opportunities for New Mexico and Montana[1]. Similar modeling might use the insect and disease extensions to FVS to simulate potential impacts from specific pathogens or insects. The Landfire national interagency effort to do nationwide fuel modeling is using FIA as one source of vegetation data. The modeling and analysis processes require skills not readily available in BLM. For a BLM-specific project, contracting the effort is the only practical option.

The FIA's emphasis is on data about trees as opposed to shrubs and herbaceous vegetation. The IWFIA field crews do identify and estimate cover of all shrub and herbaceous vegetation species with greater than 5 percent canopy cover. If weeds are noted on plots, then the extent of weed cover can be analyzed. Reports would necessarily be on a broad-scale, such as for a State. Weed and exotic species have not been reported by the FIA to date.

The FIA has a privacy policy that heavily restricts releasing the coordinates of plot locations. Basically, the policy says that plot coordinates on public land may be released to the agency responsible for managing the land, under some very specific restrictions and conditions. For BLM, a Memorandum of Understanding (MOU) and a confidentiality certification process would be required. This policy is the result of the FIA's interpretation of the Food Security Act of 1985, Public Law 99-198 [H.R.2100], December 23, 1985, Confidentiality of Information, sec.1770, as amended by H.R.3423 on November 17, 1999.

[1] Fiedler, Carl E., Charles E. Keegan III, Christopher W. Woodal, and Todd A. Morgan. A Strategic Assessment of Crown Fire Hazard in Montana: Potential Effectiveness and Costs of Hazard Reduction Treatments. USDA Forest Service Pacific Northwest Research Station Gen. Tech. Report PNW-GTR-622; November 2004.

Fiedler, Carl E., Charles E. Keegan III, Stephen H. Robertson, Todd A. Morgan, Chris W. Woodall, and John T. Chmelik. A Strategic Assessment of Fire Hazard in New Mexico. Final Report Submitted to the Joint Fire Sciences Program, February 11, 2002.

Conclusions

The use of FIA data by the BLM depends on need (project by project) and the availability of other sources of data. For example, the BLM in Western Oregon maintains a strategic inventory and FIA data would not be necessary for their projects. For other BLM offices needing data for planning on the public domain forest lands, the conclusions are:

- The FIA is the only systematic, continuous assessment that includes BLM forest lands.
- The data are meaningful at a State level and perhaps at a field office level, depending on the number of plots on BLM.
- Data analysis requires an extra effort for BLM areas at a sub-State level.
- FIA spatial products are receiving more attention by the FIA, but will likely only be available as special projects on an ecoregion basis because of the time and effort involved.

Appendix 1

BLM Dillon Field Office Tables and Graphs

The following tables and graphs were produced by importing a set of FIA tables into Microsoft Excel. The tables are based on 22 field plots on BLM land in the Dillon Field Office area. The Interior West FIA (IWFIA) analysis staff extracted the data from the Montana inventory data and provided the tables in a format suitable for use with Excel.

Interpretation of the tables and graphs allow a general description of the forest condition for the Dillon Field Office.

- Dillon has an estimated 142,000 acres of forest land (Table 1).
- The primary forest types based on land area are Douglas-fir (56%), lodgepole pine (23%) and spruce-fir (17%) (Figure 1).
- There are over 104,000 acres (Table 2) classified as sawtimber size (sawtimber has a diameter of 9 inches and greater).
- Over half of the area has relatively low site productivity, 20 to 49 cubic feet per acre per year (Table 2).
- The primary species are Douglas-fir and lodgepole pine, followed by subalpine fir and Engelmann spruce. Minor species are limber pine, whitebark pine, and Rocky Mountain juniper (Figure 4).
- The standing wood volume in sawtimber size trees is 210,588,000 cubic feet (Table 7).
- The Douglas-fir forest type has the most volume followed by the lodgepole pine type (Figure 9).
- Tree mortality compared to net annual growth (in terms of cubic volume) is low, less than 1 percent (Figure 6).
- Approximately 23 percent of the forest is overstocked and 25 percent is classed as poorly stocked (Figure 7).
- There are 12,186 acres classified as aspen habitat types that are stocked with Douglas-fir (Table 6).

Table 1. Area of forest land by forest type, BLM Dillon Field Office, 2000

Forest Type	Acres
Douglas-fir	80,017
Engelmann spruce	5,928
Lodgepole pine	32,084
Spruce-fir	24,043
All types	142,072

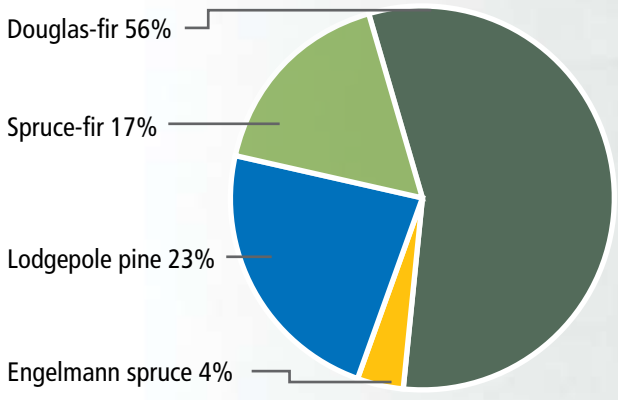


Figure1. Percent of Forestland by Forest Type

Table 2. Area of forest land by forest type, stand-size class, and productivity class, BLM Dillon Field Office, 2000

Forest Type	Stand-Size Class	Acres		
		Productivity Class		
		50-84	20-49	Total
Douglas-fir	Sawtimber	26,155	34,856	61,011
	Poletimber	5,928	13,078	19,006
	Total	32,083	47,934	80,017
Engelmann spruce	Sawtimber	5,928	0	5,928
	Poletimber	0	0	0
	Total	5,928	0	5,928
Lodgepole pine	Sawtimber	13,078	0	13,078
	Poletimber	5,928	13,078	19,006
	Total	19,006	13,078	32,084
Spruce-fir	Sawtimber	5,928	18,115	24,043
	Poletimber	0	0	0
	Total	5,928	18,115	24,043
Total	Sawtimber	51,090	52,971	104,061
	Poletimber	11,856	26,155	38,011
	Sapling/seedling	0	0	0
	Nonstocked	0	0	0
	Total	62,946	79,126	142,072

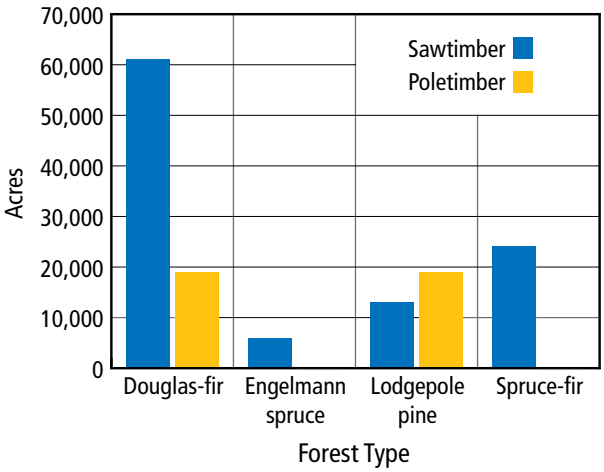


Figure 2. Area of Forestland by Forest Type and Stand Size

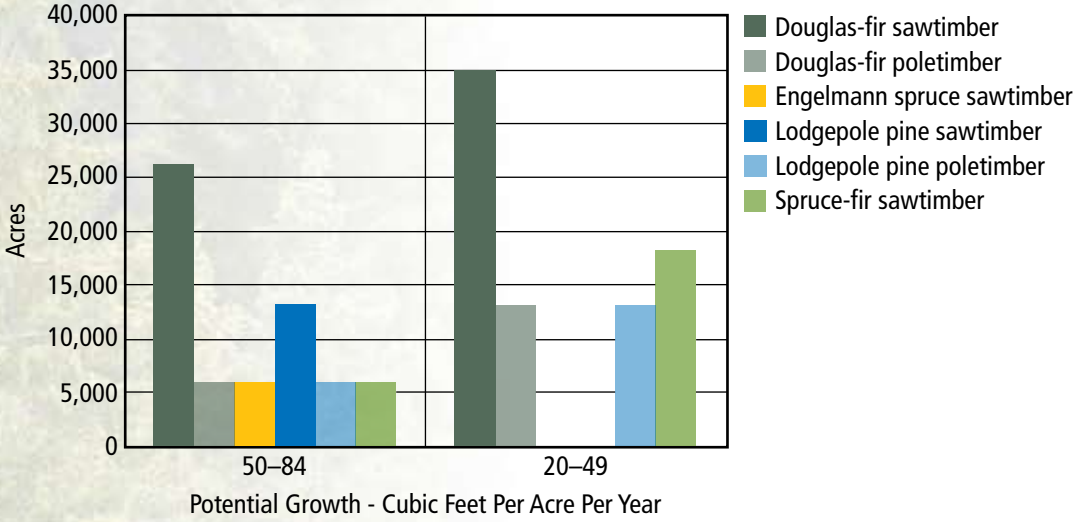


Figure 3. Area by Forest Type, Size Class, and Productivity Class

Table 3. Number of live trees on forest land by species and diameter class, BLM Dillon Field Office, 2000																
	Thousand Trees Diameter Class															
Species	1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+	All Classes
Douglas-fir	11,925	11,210	7,762	2,747	2,101	1,242	793	353	158	108	66	27	36	27	51	38,606
Engelmann spruce	1,186	593	685	598	321	145	190	82	52	17	27	0	0	0	0	3,896
Limber pine	715	1,430	1,510	155	98	130	66	0	13	0	0	0	0	0	0	4,117
Lodgepole pine	6,295	5,109	5,859	2,616	1,792	1,091	148	91	28	34	18	8	7	0	0	23,096
Rocky Mountain juniper	0	0	146	162	54	64	51	0	0	0	0	0	0	0	0	477
Subalpine fir	5,928	0	963	540	754	438	153	42	0	0	0	8	7	0	0	8,833
Whitebark pine	1,778	1,186	387	553	366	152	103	63	65	75	46	0	11	10	0	4,795
Total	27,827	19,528	17,312	7,371	5,486	3,262	1,504	631	316	234	157	43	61	37	51	83,820

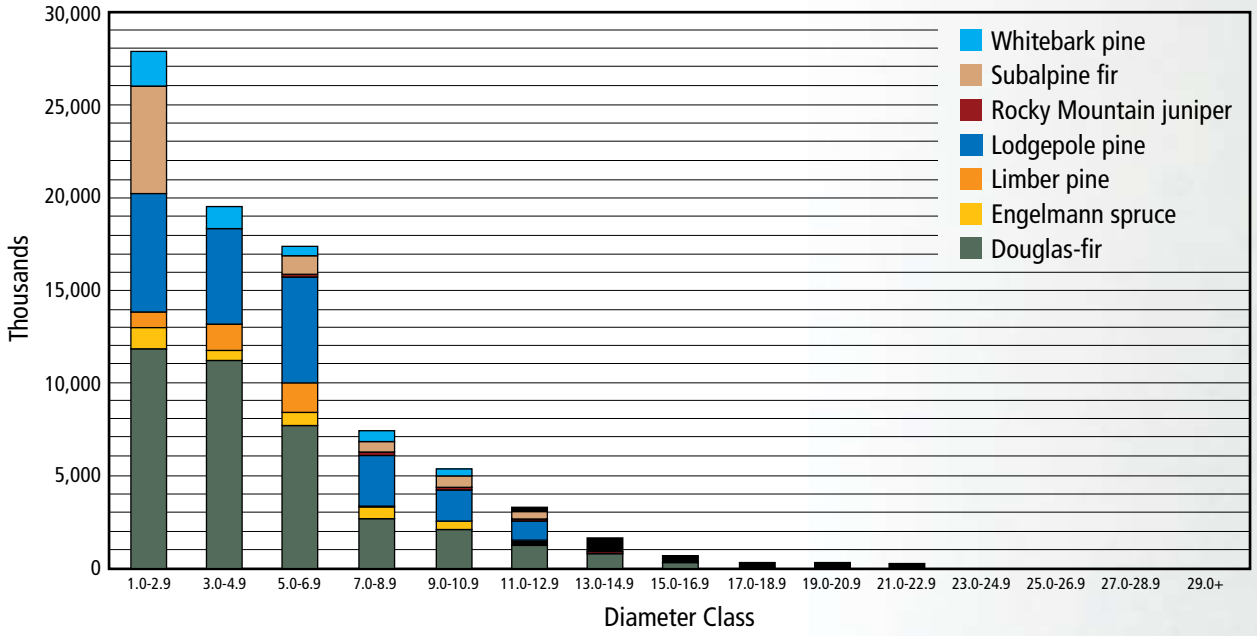
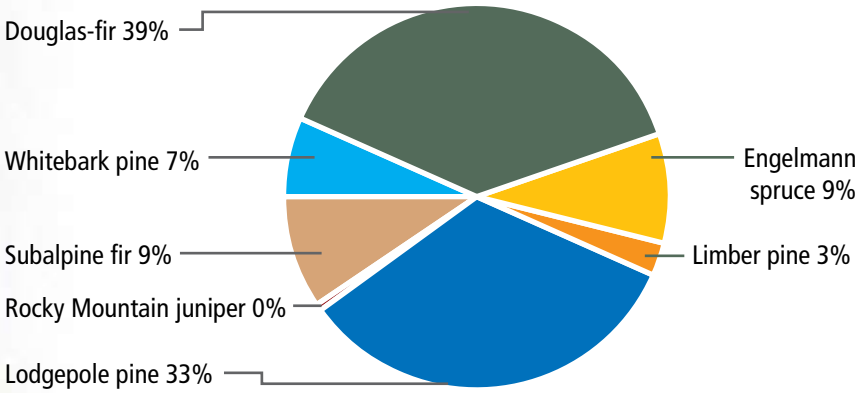


Figure 4. Number of Trees by Species and Size

Table 4. Net volume of all live trees on forest land by species and diameter class, BLM Dillon Field Office, 2000

	Thousand Cubic Feet Diameter Class													
Species	**5.0-6.9**	**7.0-8.9**	**9.0-10.9**	**11.0-12.9**	**13.0-14.9**	**15.0-16.9**	**17.0-18.9**	**19.0-20.9**	**21.0-22.9**	**23.0-24.9**	**25.0-26.9**	**27.0-28.9**	**29.0+**	**All Classes**
Douglas-fir	15,357	11,177	17,171	16,906	15,193	9,284	5,662	4,422	2,964	1,457	1,973	2,397	7,402	111,365
Engelmann spruce	2,381	4,017	3,414	2,649	5,745	3,613	2,455	833	1,754	0	0	0	0	26,861
Limber pine	3,350	706	504	1,392	1,505	0	506	0	0	0	0	0	0	7,963
Lodgepole pine	18,072	20,375	22,922	22,229	4,069	3,749	1,394	1,750	1,268	671	556	0	0	97,055
Rocky Mountain juniper	152	199	132	361	300	0	0	0	0	0	0	0	0	1,144
Subalpine fir	4,044	3,839	8,064	6,824	3,155	629	0	0	0	483	446	0	0	27,484
Whitebark pine	736	2,815	2,875	2,332	1,854	1,702	2,310	2,061	1,663	0	641	163	0	19,152
Total	44,092	43,128	55,082	52,693	31,821	18,977	12,327	9,066	7,649	2,611	3,616	2,560	7,402	291,024

Figure 5. Total Cubic-Foot Volume by Species



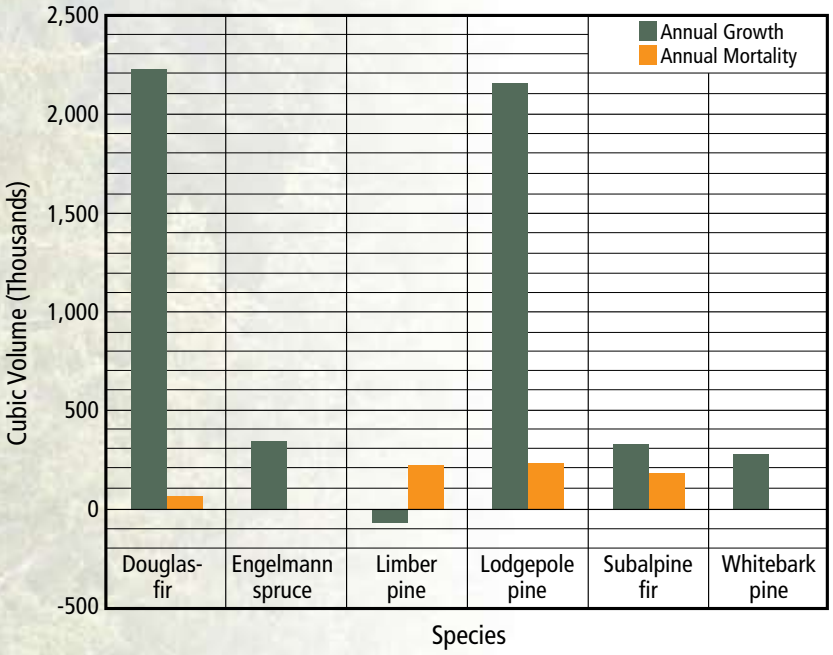


Figure 6. Net Annual Growth by Species Compared to Mortality

Table 5. Area of forest land by forest type and stocking condition, BLM Dillon Field Office, 2000					
	Acres Stocking Condition				
Forest Type	Overstocked	Fully Stocked	Medium Stocked	Poorly Stocked	Total
Douglas-fir	13,078	13,078	25,264	28,598	80,018
Engelmann spruce	0	0	5,928	0	5,928
Lodgepole pine	13,078	13,078	5,928	0	32,084
Spruce-fir	5,928	5,928	5,928	6,258	24,042
All types	32,084	32,084	43,048	34,856	142,072

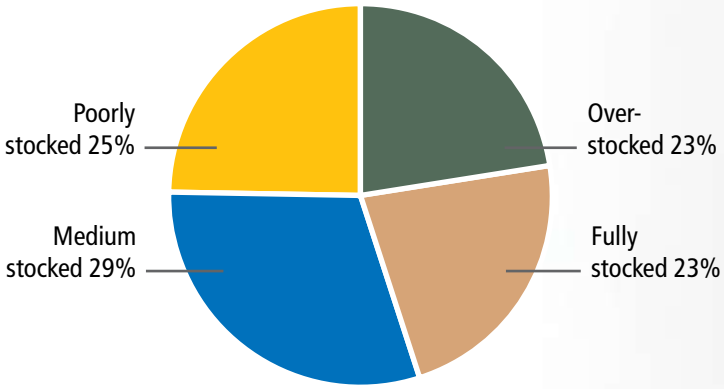


Figure 7. Acres by Stocking Condition

Table 6. Area of forest land by habitat type series and forest type, BLM Dillon Field Office, 2000					
	Acres				
	Forest Type				
Habitat Type Series	Douglas-fir	Engelmann spruce	Lodgepole pine	Spruce-fir	All Types
Unclassified	5,928	5,928	0	0	11,856
Douglas-fir	61,903	0	13,078	0	74,981
Subalpine fir	0	0	13,078	12,186	25,264
White fir	0	0	0	11,856	11,856
Lodgepole pine	0	0	5,928	0	5,928
Aspen	12,186	0	0	0	12,186
All types	80,017	5,928	32,084	24,042	142,072

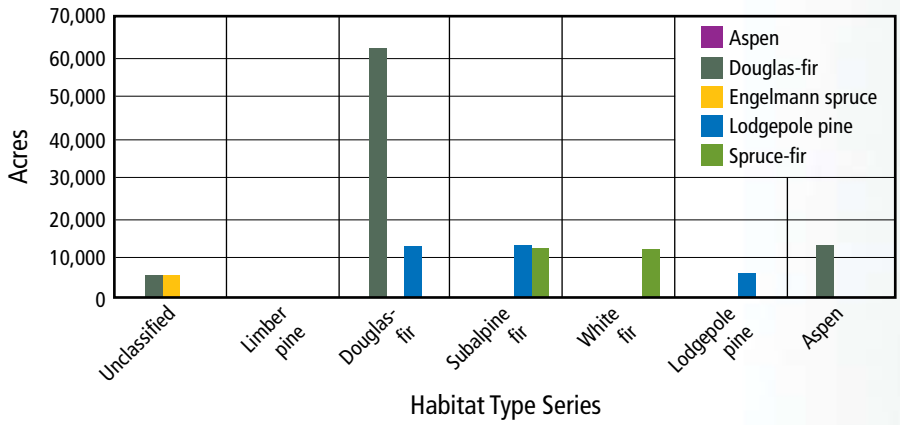


Figure 8. Forest Land Area by Habitat Type Series and Forest Type

Table 7. Net volume of all live trees on forest land by forest type and stand-size class, BLM Dillon Field Office, 2000			
Thousand Cubic Feet			
	Stand-Size Class		
Forest Type	Sawtimber	Poletimber	All Classes
Douglas-fir	91,546	21,952	113,498
Engelmann spruce	15,843	0	15,843
Lodgepole pine	44,496	58,485	102,981
Spruce-fir	58,703	0	58,703
All types	210,588	80,437	291,025

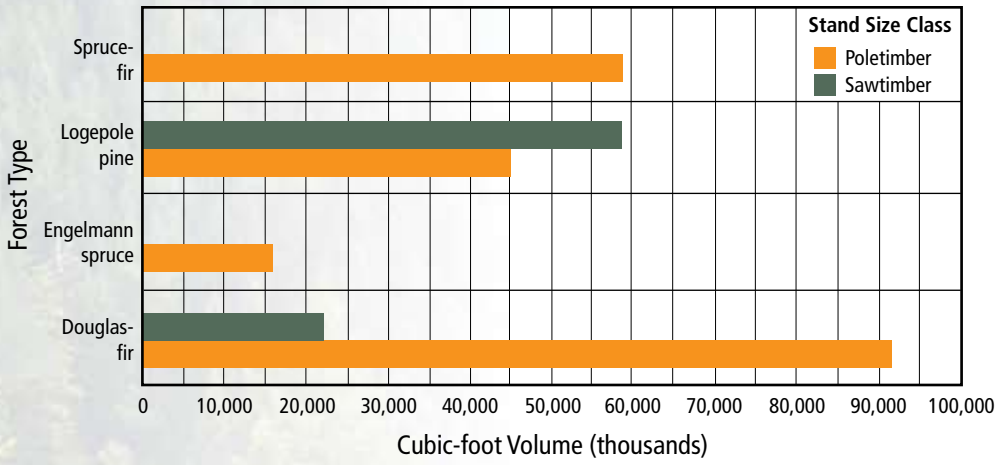


Figure 9. Net Volume by Forest Type and Stand Size

Table 8. Net volume of all live trees on forest land by species and forest type, BLM Dillon Field Office, 2000					
Thousand Cubic Feet					
	Forest Type				
Species	Douglas-fir	Engelmann spruce	Lodgepole pine	Spruce-fir	All Types
Douglas-fir	93,427	5,403	5,648	6,888	111,366
Engelmann spruce	5,647	10,441	6,007	4,766	26,861
Limber pine	7,068	0	565	329	7,962
Lodgepole pine	5,699	0	83,184	8,172	97,055
Rocky Mountain juniper	1,144	0	0	0	1,144
Subalpine fir	512	0	7,578	19,395	27,485
Whitebark pine	0	0	0	19,153	19,153
Total	113,497	15,844	102,982	58,703	291,026

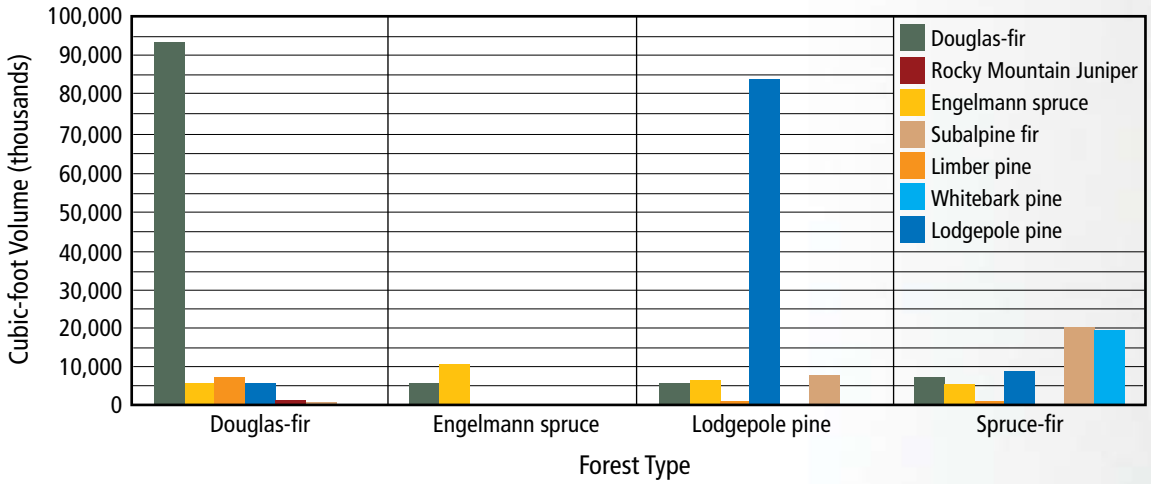


Figure 10. Net Cubic Volume by Forest Type and Species

Appendix 2

BLM Albuquerque Field Office Tables and Graphs

BLM Albuquerque Field Office Tables and Graphs
The following tables and graphs were produced by importing a set of FIA tables into Microsoft Excel. The tables are based on 40 field plots on BLM land in the Albuquerque Field Office area. The Interior West FIA (IWFIA) analysis staff extracted the data from the New Mexico inventory data and provided the tables in a format suitable for use with Excel.

Interpretation of the tables and graphs allow a general description of the forest condition for the Albuquerque Field Office.

- Albuquerque has an estimated 285,174 acres of forest land (Table 1).
- Fifty-four percent (54%) of these acres are in reserve status. All of the ponderosa pine acres are reserved (Figure 1).
- The pinyon-juniper forest type is by far the most common type (almost 220,000 acres); there are 11,864 acres in the juniper type. Stocked ponderosa pine (20,555 acres) and nonstocked ponderosa pine (14,431 acres) type total 34,986 acres (Table 2).
- Twelve percent (12%) of the forest acres are nonstocked (Figure 3).
- Productivity of the woodland types is low; growth is less than 20 cubic feet per acre per year (Table 2 and Figure 2).
- Oneseed juniper and two needle pinyon are the predominant species (Table 4).
- Most of the trees are in diameter classes of 6 inches and less (Figure 5).
- Approximately 91,000 acres are in age classes greater than 100; no acres were classed older than 200 years (Table 6).
- Sixty percent (60%) of the pinyon-juniper type is in the “sawtimber” size class (diameter class 9 inches and greater). All of the ponderosa pine type is in the sawtimber size class (Table 7).

Table 1. Area of forest land by forest type and land class, BLM Albuquerque Field Office, 2000			
Acres			
Forest Type	Nonreserved	Reserved	Total
Juniper	11,864		11,864
Pinyon-juniper	118,939	100,819	219,758
Ponderosa pine		20,555	20,555
Nonstocked timberland		14,431	14,431
Nonstocked woodland		18,566	18,566
All types	130,803	154,371	285,174

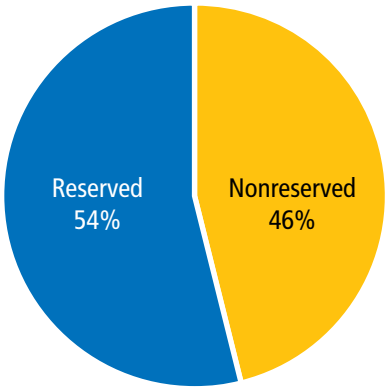


Figure1. Forest by Land Class

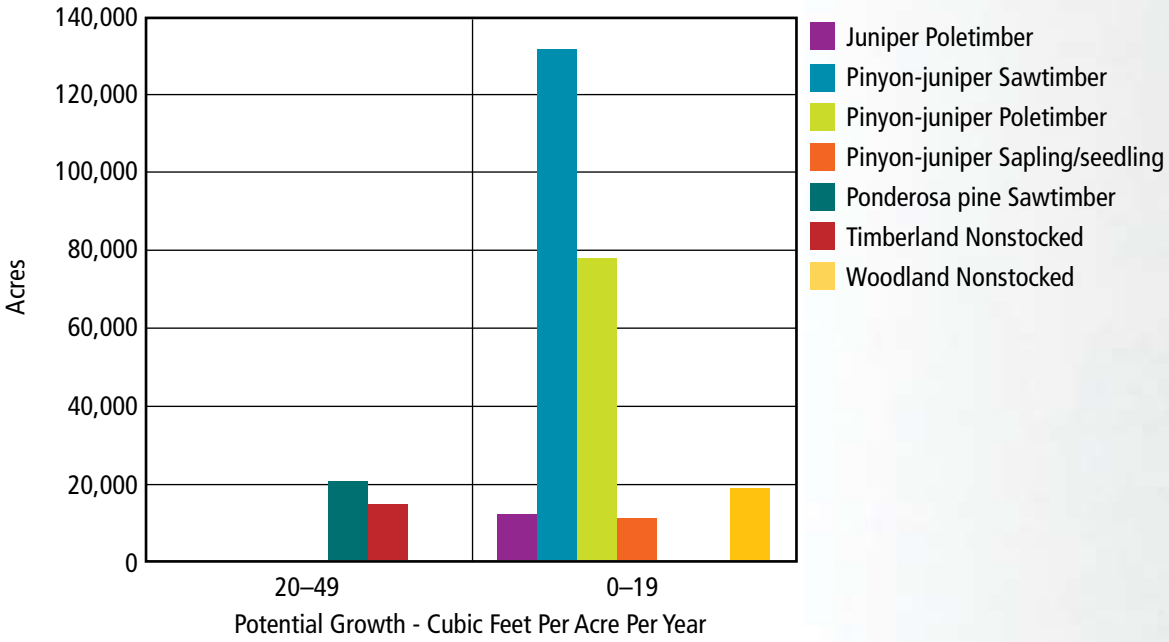


Figure 2. Area by Forest Type, Size Class, and Productivity Class

Table 2. Area of forest land by forest type, stand-size class, and productivity class, BLM Albuquerque Field Office, 2000				
Acres				
Forest Type	Stand-Size Class	Productivity Class		
		20-49	0-19	Total
Juniper	Poletimber		11,864	11,864
Pinyon-juniper	Sawtimber		131,418	131,418
	Poletimber		77,516	77,516
	Sapling/seedling		10,823	10,823
	Total		219,757	219,757
Ponderosa pine	Sawtimber	20,555		20,555
Nonstocked timberland		14,431		14,431
Nonstocked woodland			18,566	18,566
Total	Sawtimber	20,555	131,418	151,973
	Poletimber		89,380	89,380
	Sapling/seedling		10,823	10,823
	Nonstocked	14,431	18,566	32,997
	Total	34,986	250,187	285,173

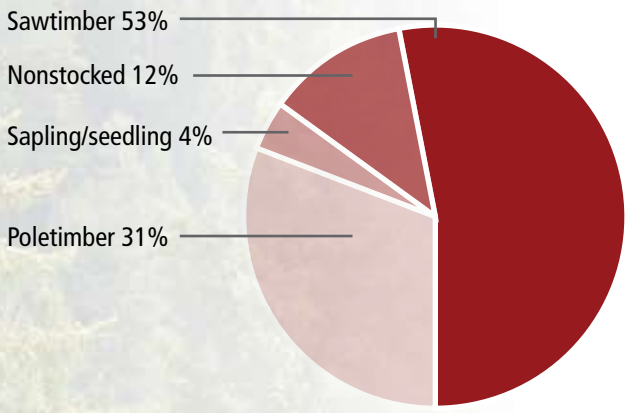


Figure 3. Forestland by Size Class

Table 3. Area of forest land by forest type and basal area class, BLM Albuquerque Field Office, 2000									
	Basal Area Class								
	Acres								
	0	1-25	26-50	51-75	76-100	101-150	151-200	201-250	Total
Juniper		5,932		5,932					11,864
Pinyon-juniper	3,608	28,674	41,345	19,705	62,117	41,246	7,215	15,848	219,758
Ponderosa pine			13,340			7,215			20,555
Timberland*	7,215	7,215							14,430
Woodland*	11,351	7,215							18,566
Total	22,174	49,036	54,685	25,637	62,117	48,461	7,215	15,848	285,173
*Nonstocked									

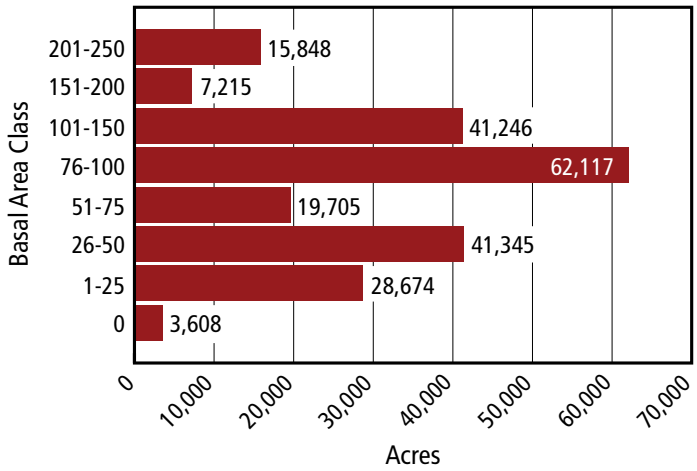


Figure 4. Acres of Pinyon-juniper by Basal Area Class

Table 4. Number of live trees on forest land by species and diameter class, BLM Albuquerque Field Office, 2000

Thousand Trees													
Diameter Class (inches)													
Species	2	4	6	8	10	12	14	16	18	20	22	24+	All Classes
Alligator juniper					74							43	117
Border pinyon	541												541
Oneseed juniper	3,207	647	1,059	969	1,816	1,621	1,440	1,240	678	760	456	486	14,379
Ponderosa pine			304	347	87	130	130	174	217	43			1,432
Rocky Mtn. juniper	555	541	235	328	427	359	130	80	155	43	37		2,890
Two needle pinyon	6,588	2,917	4,082	2,886	1,982	696	342	310	87	43		37	19,970
Utah juniper												43	43
Total Softwoods	10,891	4,105	5,680	4,530	4,386	2,806	2,042	1,804	1,137	889	493	609	39,372
Arizona white oak	541												541
Gambel oak	541	541	43										1,125
Total Hardwoods	1,082	541	43										1,666
All species	11,973	4,646	5,723	4,530	4,386	2,806	2,042	1,804	1,137	889	493	609	41,038

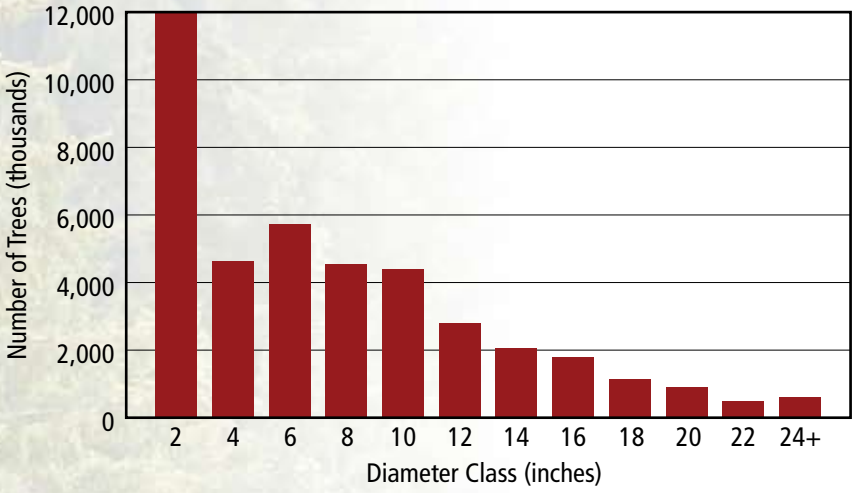


Figure 5. Number of Live Trees by Diameter Class

Table 5. Net volume of all live trees on forest land by species and forest type, BLM Albuquerque Field Office, 2000						
	Thousand Cubic Feet					
	Forest Type					
Species	Juniper	Pinyon-juniper	Ponderosa pine	Nonstocked Timberland	Nonstocked Woodland	All Types
Alligator juniper		181	1,801			1,982
Oneseed juniper	1,927	59,994				61,921
Ponderosa pine		263	18,427	1,805		20,495
Rocky Mtn juniper		9,202				9,202
Two needle pinyon		45,940	853		357	47,150
Utah juniper		2,306				2,306
Total softwoods	1,927	117,886	21,081	1,805	357	143,056
Gambel oak			47			47
Total hardwoods			47			47
All species	1,927	117,886	21,128	1,805	357	143,103

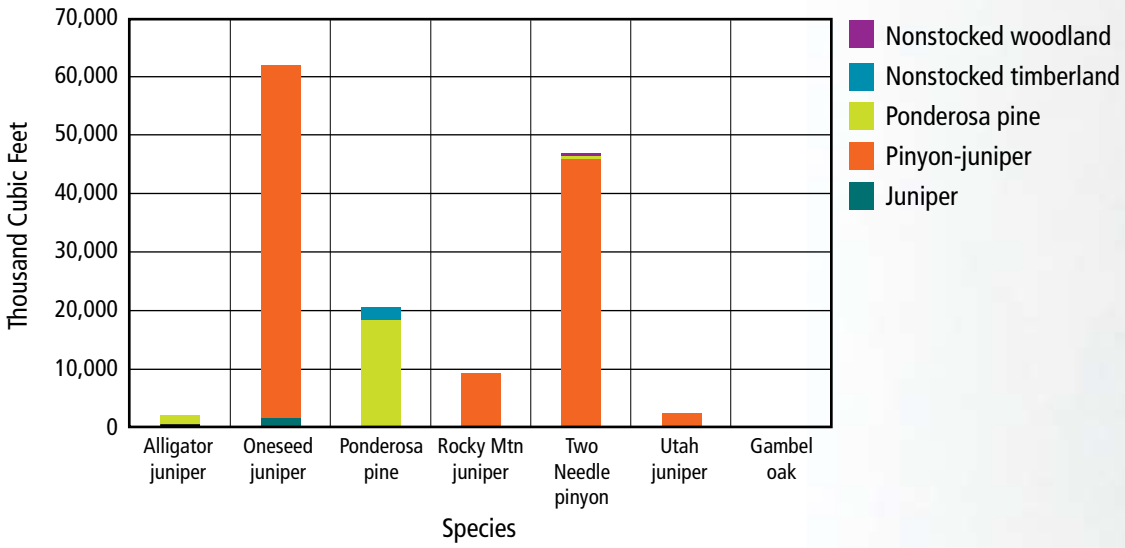


Figure 6. Net Volume, All Live Trees By Species and Forest Type

Table 6. Area of forest land by forest type and stand-age class, BLM Albuquerque Field Office, 2000						
	Acres					
Forest-Type	Stand-Age Class					
	Unclassified/ Nonstocked	1-50	51-100	101-150	151-200	All Classes
Juniper	0	5,932	5,932			11,864
Pinyon-juniper	8,632	18,038	108,116	51,598	33,373	219,757
Ponderosa pine	0	0	13,340		7,215	20,555
Nonstocked timberland	14,431					14,431
Nonstocked woodland	18,566					18,566
All types	41,629	23,970	127,388	51,598	40,588	285,173

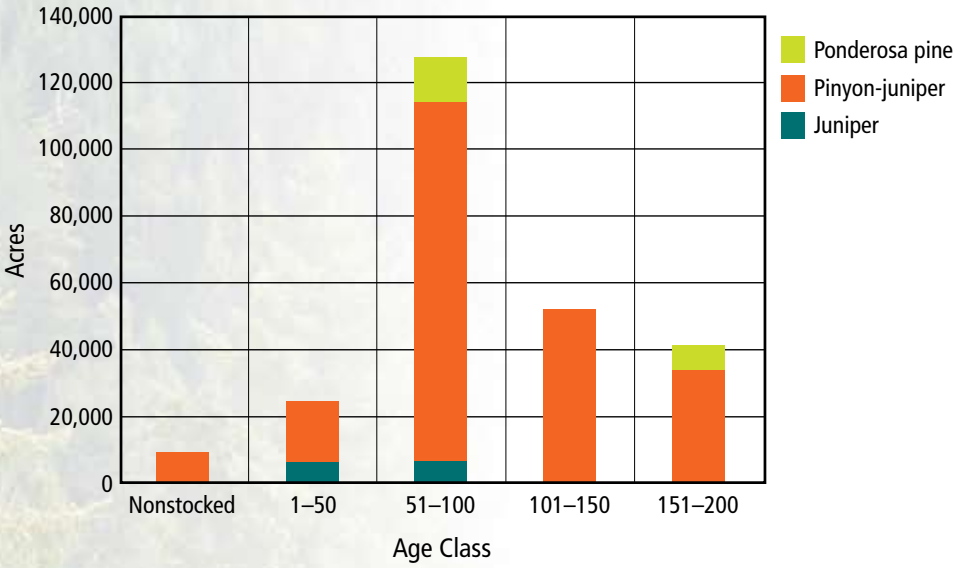


Figure 7. Area by Age Class and Forest Type

Table 7. Net volume of all live trees on forest land by forest type and stand-size class, BLM Albuquerque Field Office, 2000					
	Thousand Cubic Feet				
Forest Type	Sawtimber	Poletimber	Sapling/ seedling	Nonstocked	All Classes
Juniper		1,927			1,927
Pinyon-juniper	83,649	32,464	1,774		117,887
Ponderosa pine	21,127				21,127
Nonstocked timberland				1,805	1,805
Nonstocked woodland				357	357
All Types	104,776	34,391	1,774	2,162	143,103

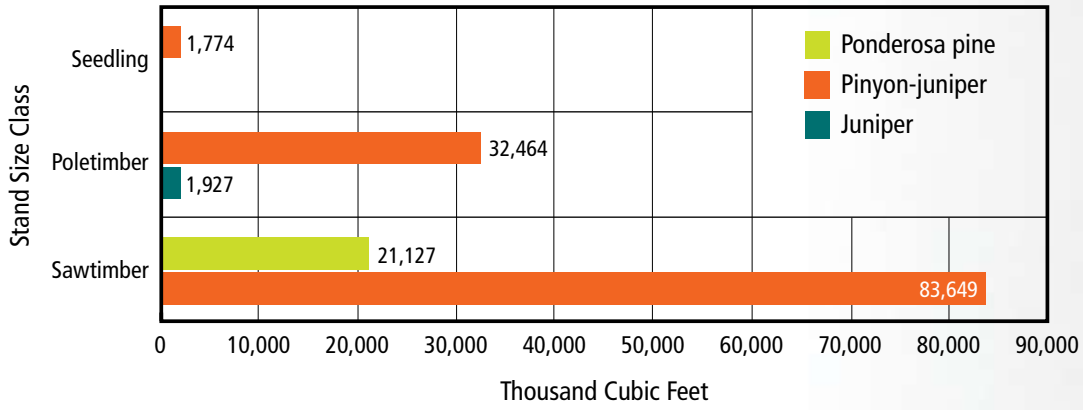


Figure 8. Net Volume by Size Class

Appendix 3

BLM Dillon Field Office Maps

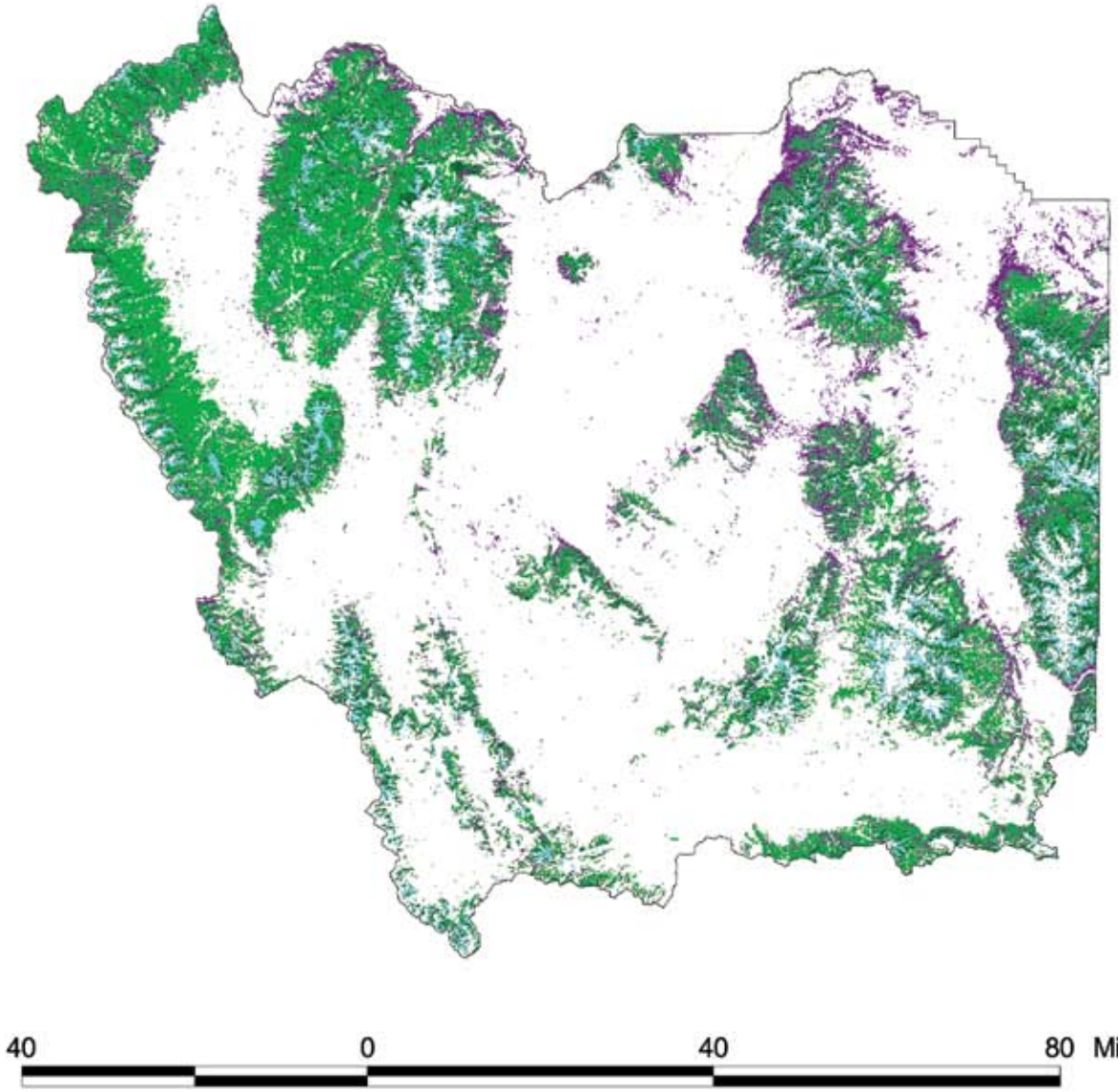
The following maps are examples of modeled forest attributes that include forest type, tree canopy cover, average tree diameter, and tree volumes for the BLM Dillon Field Office.

The maps are exported from a GIS project file. The developer provided query and display functions for making the maps. Each map could be refined to show a range or subset of attribute values, such as a map of biomass in excess of some minimum per acre value.

The BLM did not conduct a rigorous accuracy assessment of the classifications. The products met with generally positive response. There was some concern that the forest typing was slightly in error. There was a consistent misclassification of low- to mid-elevation Douglas-fir as lodgepole pine. Limber pine presence was generally not shown on the map. Also, the spruce-fir type was over estimated; areas more predominantly lodgepole pine or Douglas-fir were classed as spruce-fir.

Because the attribute values shown can be defined by the user, maps can be tailored to answer fairly specific questions about the forest resource. The information shown is modeled, or predicted, based on observations from a small number of field locations; therefore, the maps cannot be used for locating specific sites for management activities. The maps do show the extent and general location of forest resources attributes over a landscape and they have value for that purpose.

BLM DILLON FIELD OFFICE



40 0 40 80 Miles

BLM Boundary

Forest Type

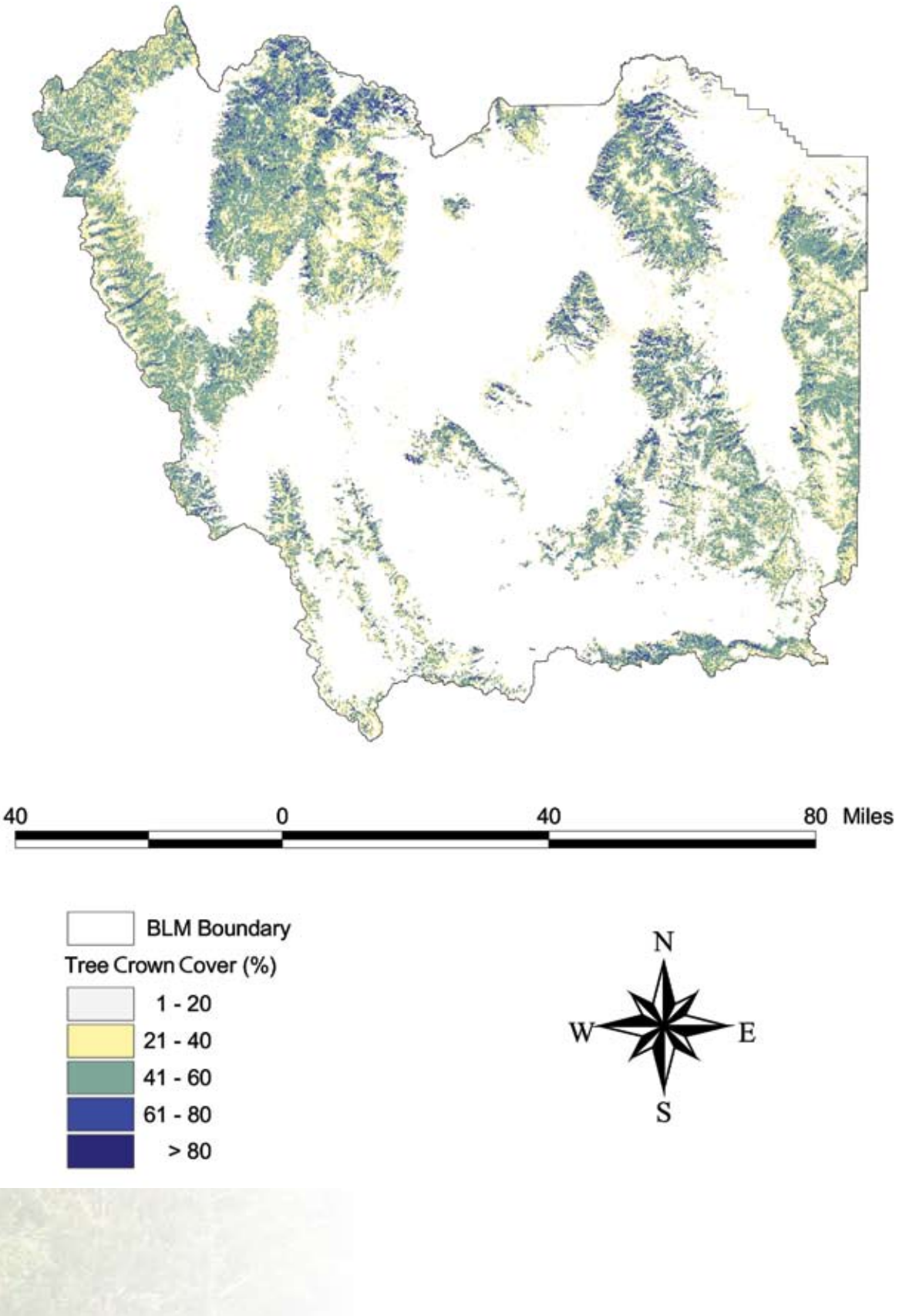
- Douglas-fir
- Spruce-fir
- Lodgepole pine
- Ponderosa pine
- Whitebark pine
- Limber pine
- Aspen

N

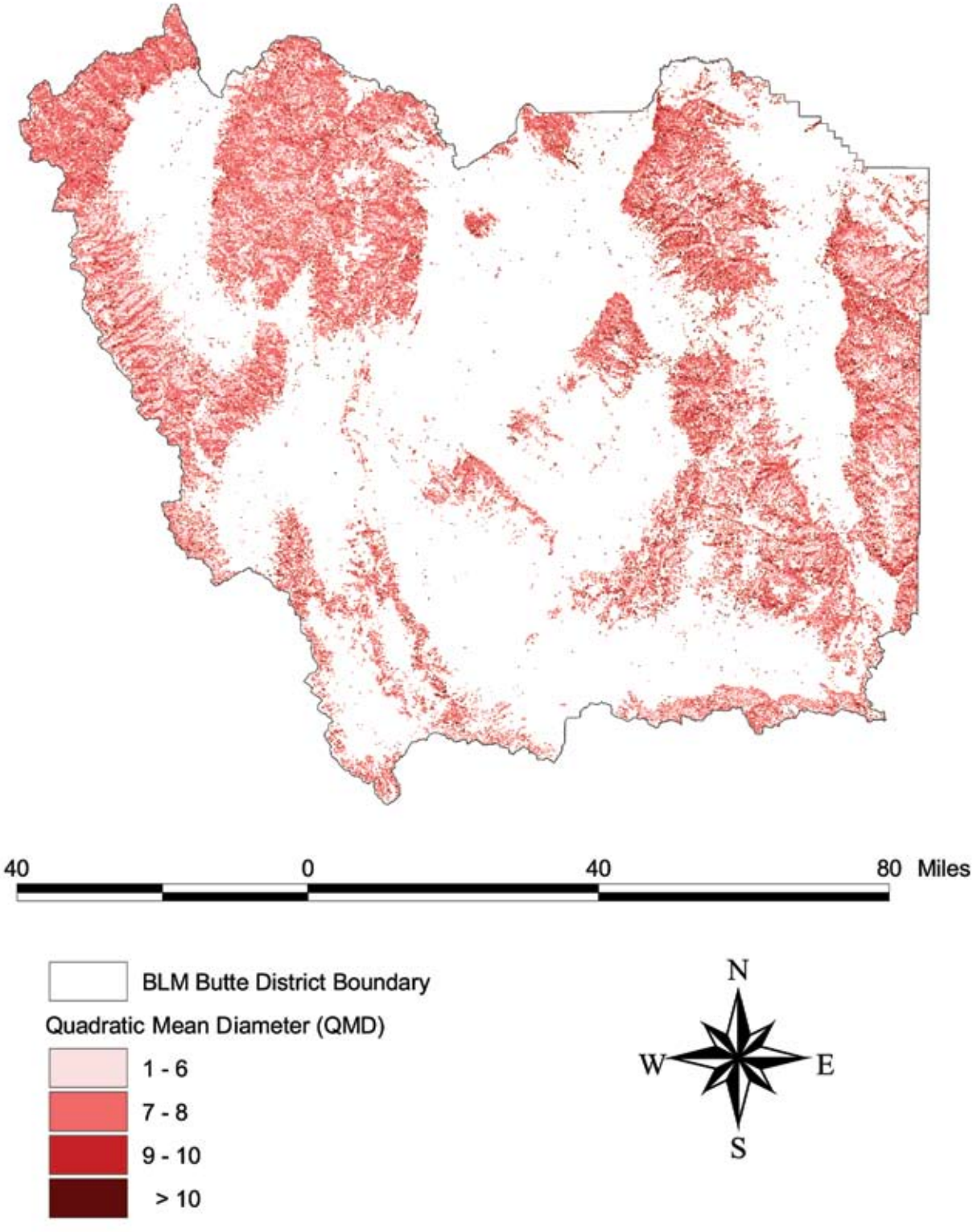
W E

S

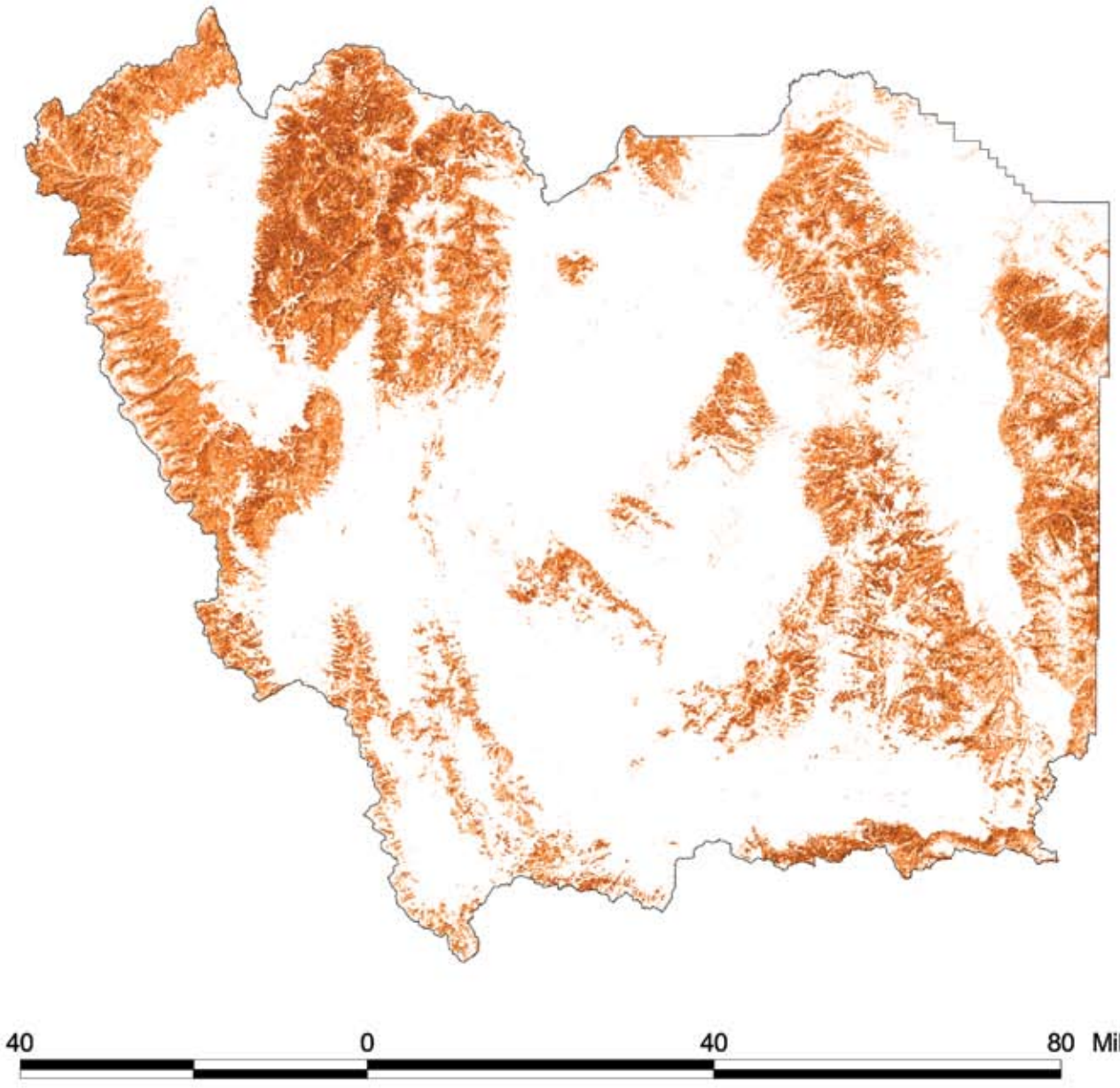
BLM DILLON FIELD OFFICE



BLM DILLON FIELD OFFICE



BLM DILLON FIELD OFFICE



BLM DILLON FIELD OFFICE